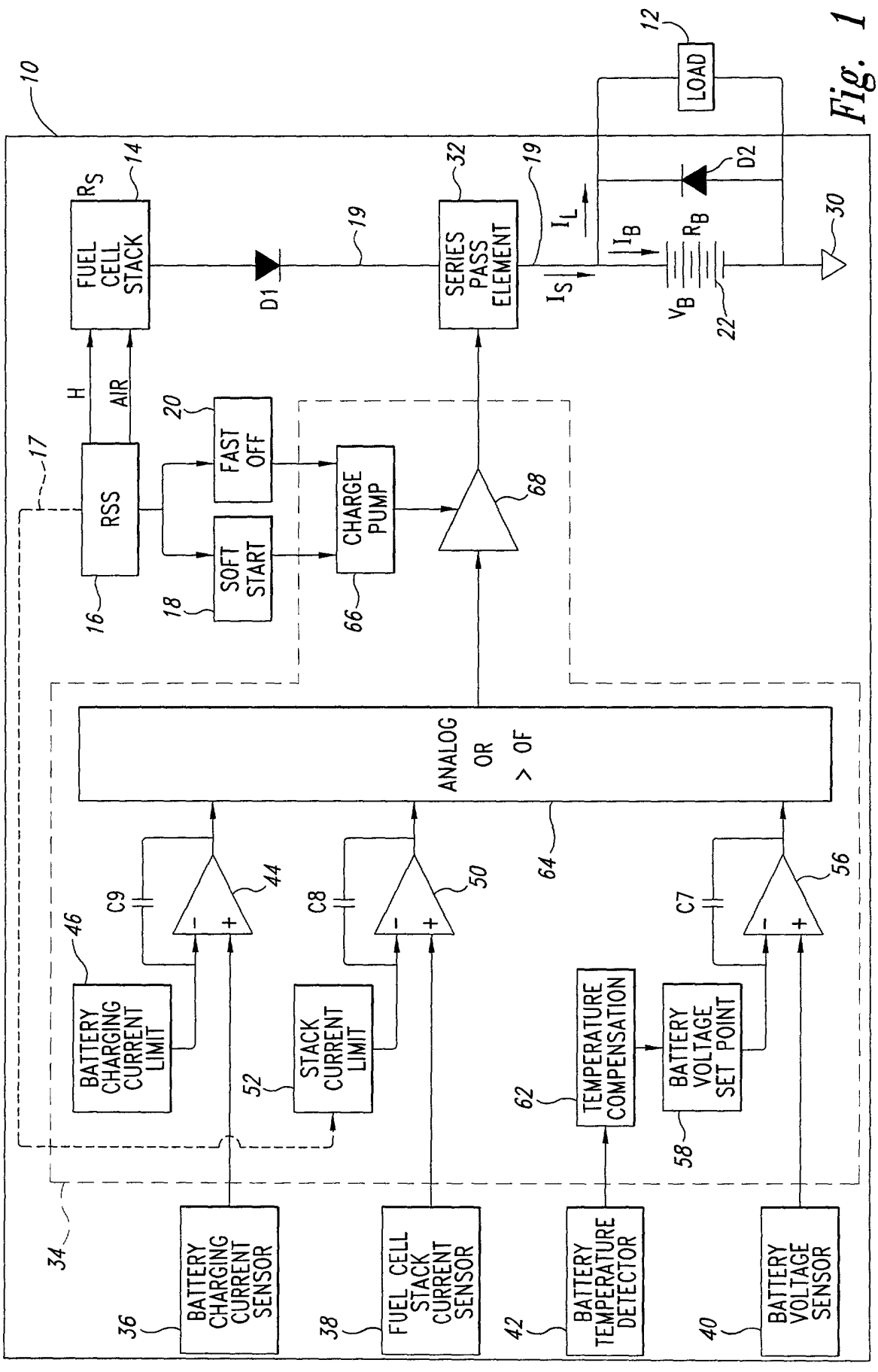

10
12
LOAD
FUEL CELL STACK
14
R_S
D1
19
SERIES PASS ELEMENT
32
I_L
I_B
R_B
D2
30
I_S
V_B
22
H
AIR
17
RSS
16
20
FAST OFF
18
SOFT START
CHARGE PUMP
66
68
ANALOG OR > OF
64
C9
44
C8
50
C7
56
46
BATTERY CHARGING CURRENT LIMIT
52
STACK CURRENT LIMIT
62
TEMPERATURE COMPENSATION
BATTERY VOLTAGE SET POINT
58
34
36
BATTERY CHARGING CURRENT SENSOR
38
FUEL CELL STACK CURRENT SENSOR
42
BATTERY TEMPERATURE DETECTOR
40
BATTERY VOLTAGE SENSOR

Fig. 1

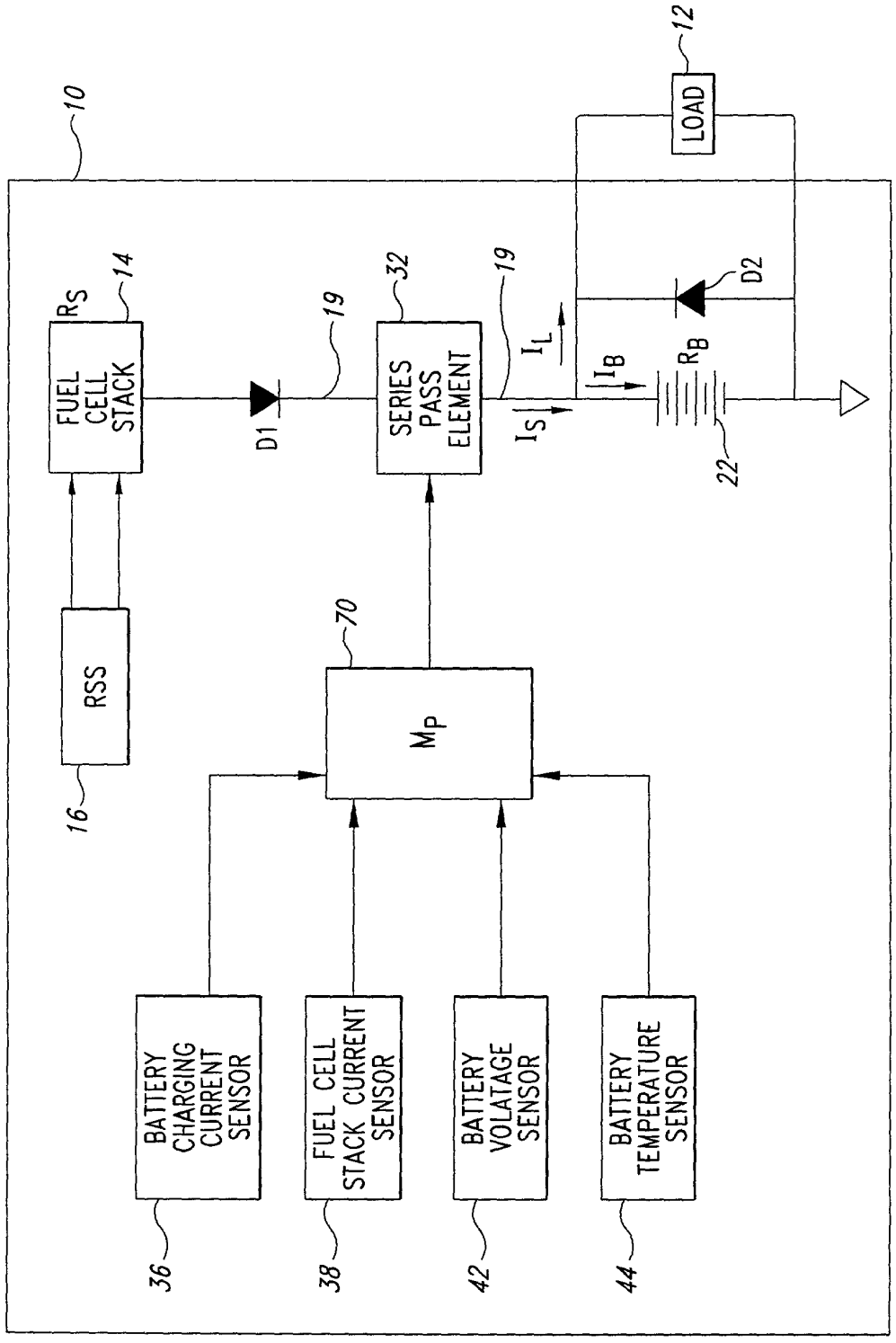

10
12
LOAD
FUEL CELL STACK
R_S
14
D1
19
SERIES PASS ELEMENT
32
19
I_L
I_S
I_B
R_B
D2
22
RSS
16
M_P
70
BATTERY CHARGING CURRENT SENSOR
36
FUEL CELL STACK CURRENT SENSOR
38
BATTERY VOLATAGE SENSOR
42
BATTERY TEMPERATURE SENSOR
44

Fig. 2

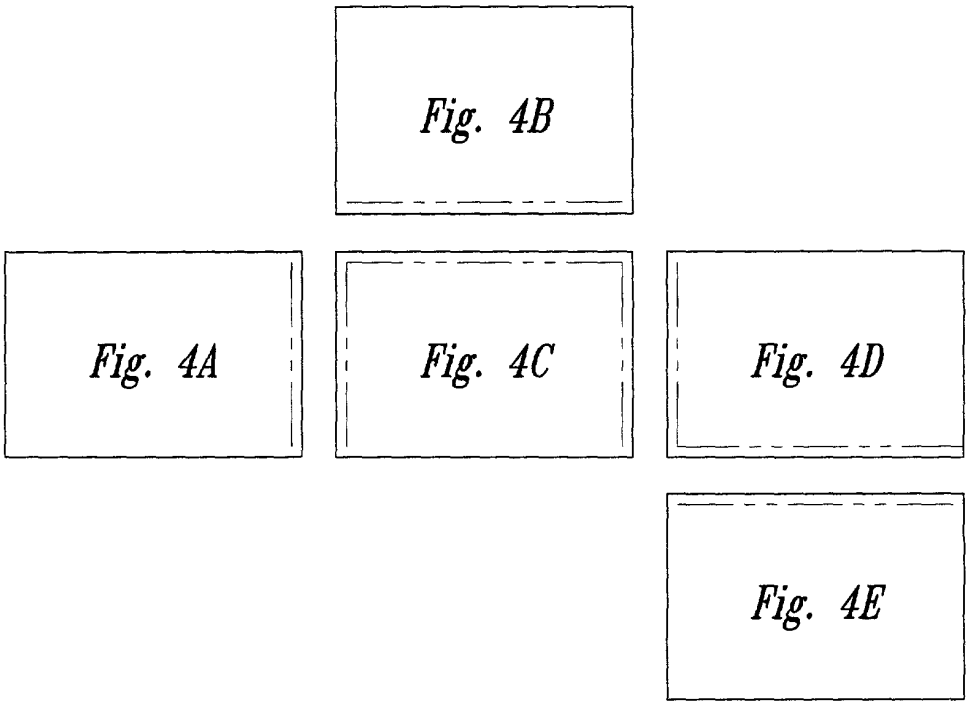


Fig. 3

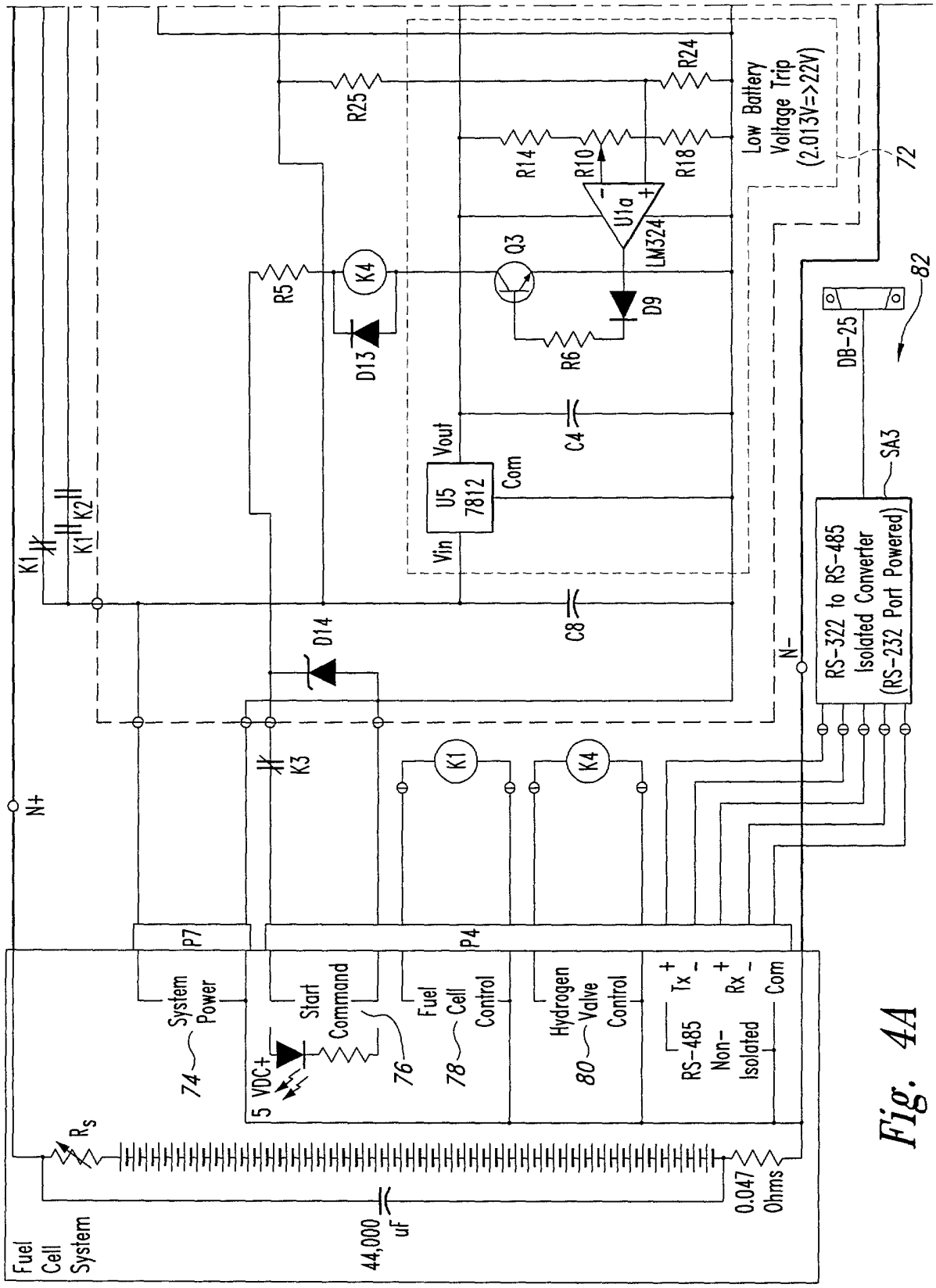

Low Battery Voltage Trip (2.013V=>22V)
72
R24
R25
R14
R10
R18
U1a
LM324
Q3
K4
R5
D13
D9
R6
C4
Vout
U5 7812
Com
Vin
C8
D14
K1
K2
K3
N+
N-
DB-25
82
SA3
RS-322 to RS-485 Isolated Converter (RS-232 Port Powered)
P7
P4
System Power
74
Start Command
76
Fuel Cell Control
78
Hydrogen Valve Control
80
RS-485 Non-Isolated
Tx +
Tx -
Rx +
Rx -
Com
5 VDC+
Rs
0.047 Ohms
44,000 uF
Fuel Cell System

Fig. 4A

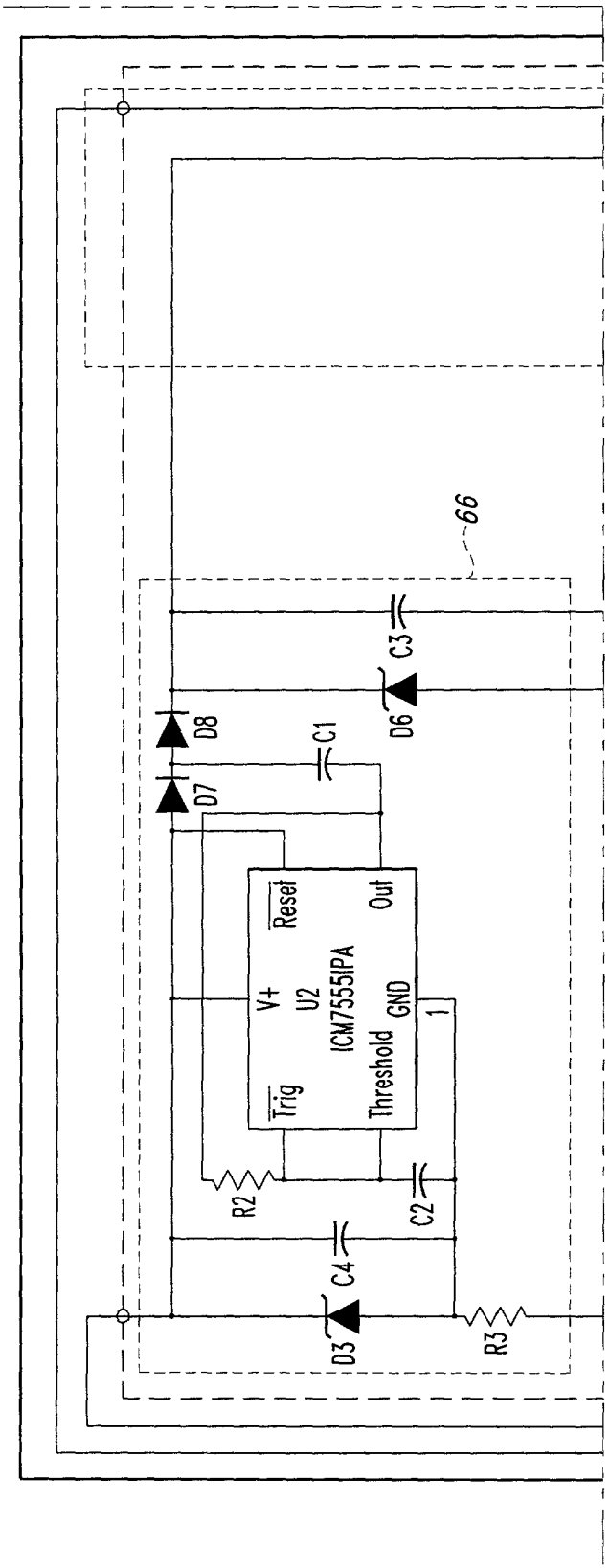

66
C3
D6
D8
C1
D7
Reset
Out
V+
U2
ICM7555IPA
GND
1
Trig
Threshold
R2
C2
C4
D3
R3

Fig. 4B

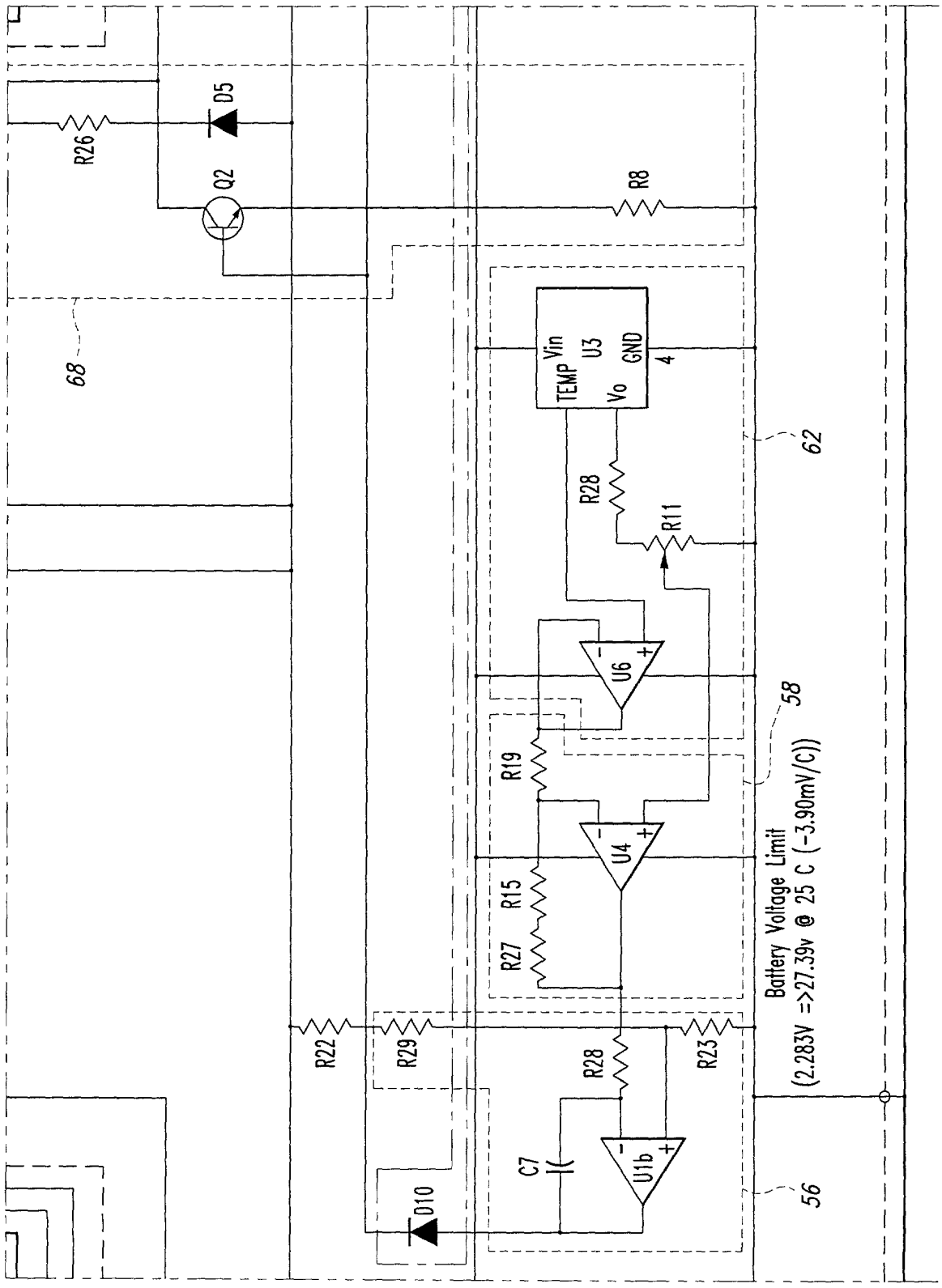
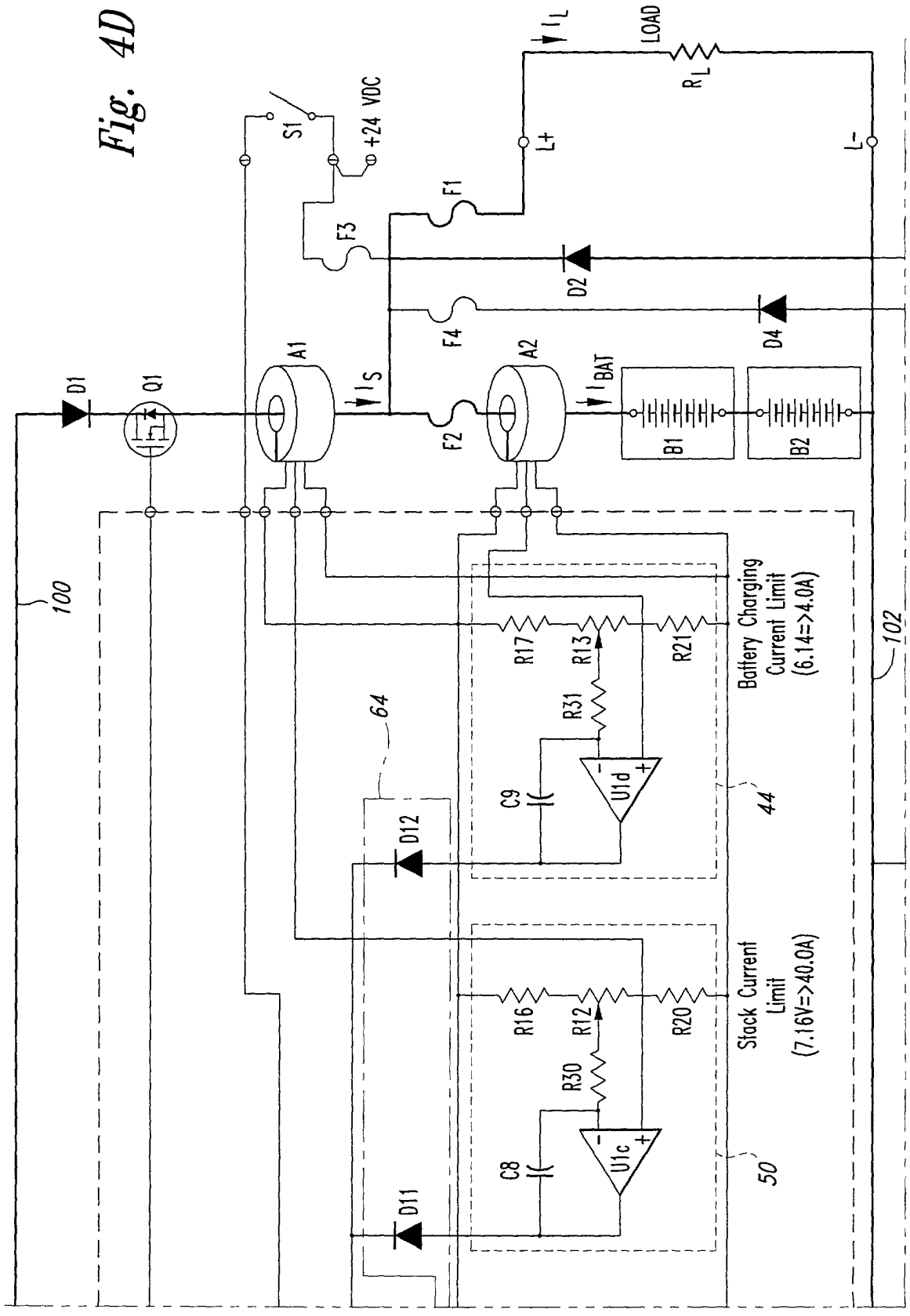

R26
D5
Q2
R8
68
TEMP
Vin
U3
GND
Vo
4
62
R28
R11
U6
58
R19
U4
R15
R27
Battery Voltage Limit
(2.283V =>27.39v @ 25 C (-3.90mV/C))
R22
R29
R28
R23
C7
U1b
D10
56

Fig. 4C

Fig. 4D


S1
+24 VDC
F3
F1
L+
I_L
LOAD
R_L
L-
D2
F4
D4
D1
Q1
A1
I_S
F2
A2
I_{BAT}
B1
B2
100
102
R17
R13
R21
Battery Charging Current Limit (6.14=>4.0A)
R31
64
C9
U1d
44
D12
R16
R12
R20
Stack Current Limit (7.16V=>40.0A)
R30
C8
U1c
50
D11

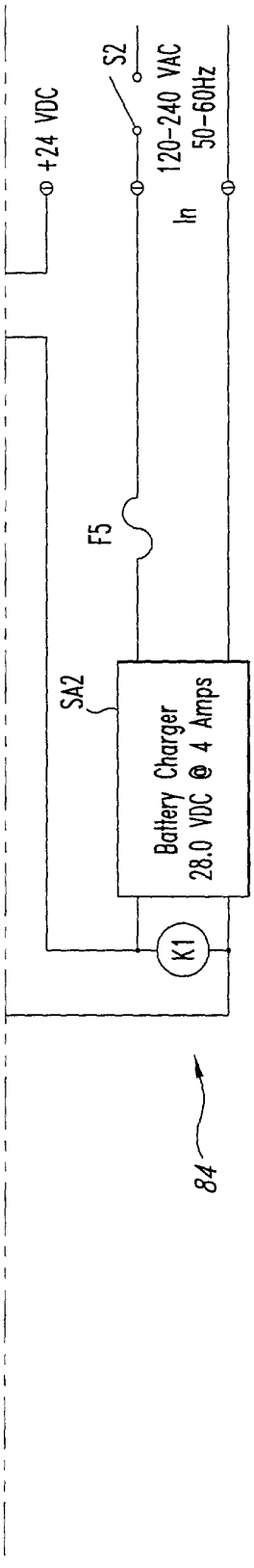

+24 VDC
S2
120-240 VAC
50-60Hz
In
F5
SA2
Battery Charger
28.0 VDC @ 4 Amps
K1
84

Fig. 4E

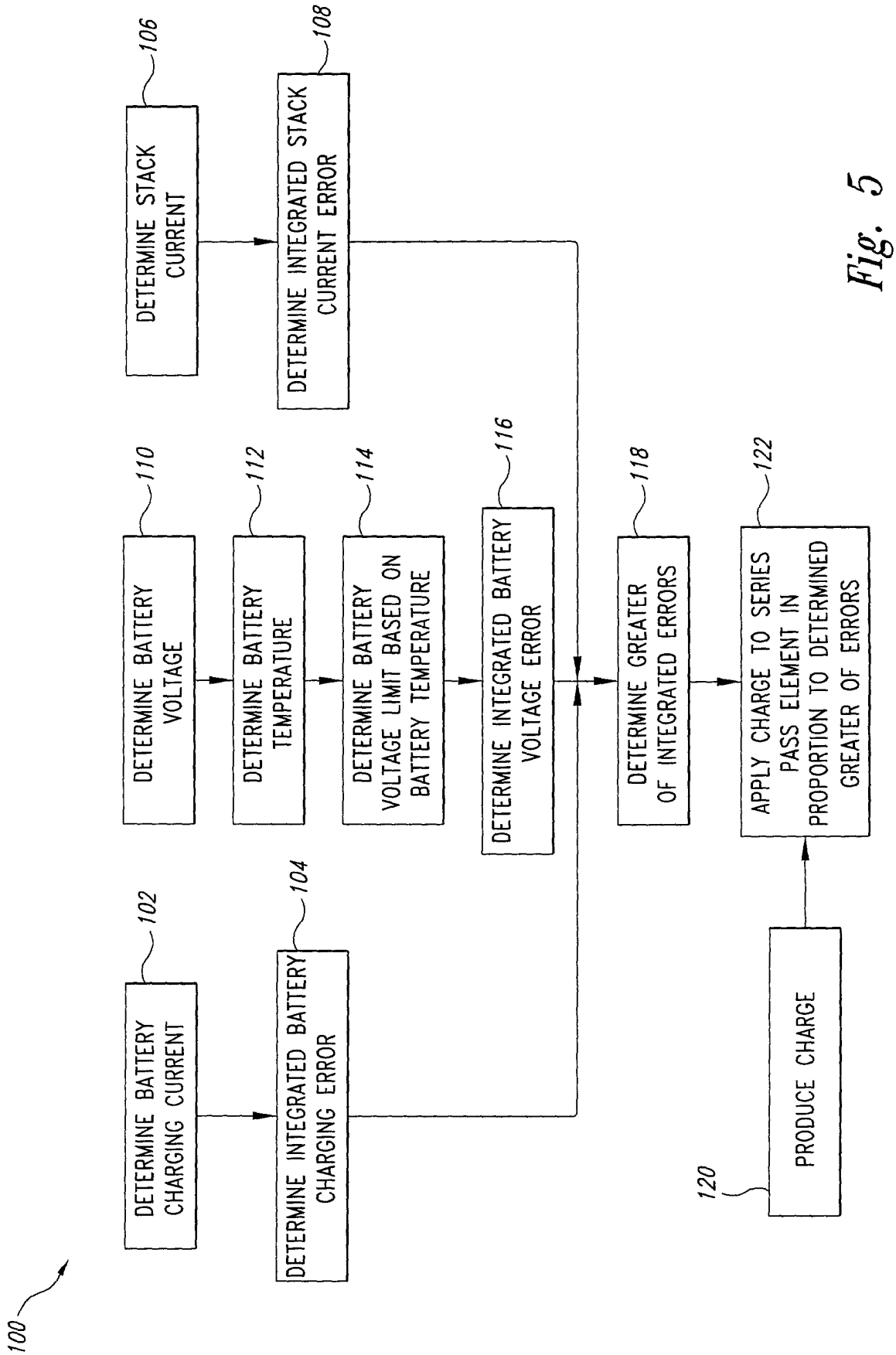

100
DETERMINE BATTERY CHARGING CURRENT
102
DETERMINE INTEGRATED BATTERY CHARGING ERROR
104
DETERMINE STACK CURRENT
106
DETERMINE INTEGRATED STACK CURRENT ERROR
108
DETERMINE BATTERY VOLTAGE
110
DETERMINE BATTERY TEMPERATURE
112
DETERMINE BATTERY VOLTAGE LIMIT BASED ON BATTERY TEMPERATURE
114
DETERMINE INTEGRATED BATTERY VOLTAGE ERROR
116
DETERMINE GREATER OF INTEGRATED ERRORS
118
PRODUCE CHARGE
120
APPLY CHARGE TO SERIES PASS ELEMENT IN PROPORTION TO DETERMINED GREATER OF ERRORS
122

Fig. 5

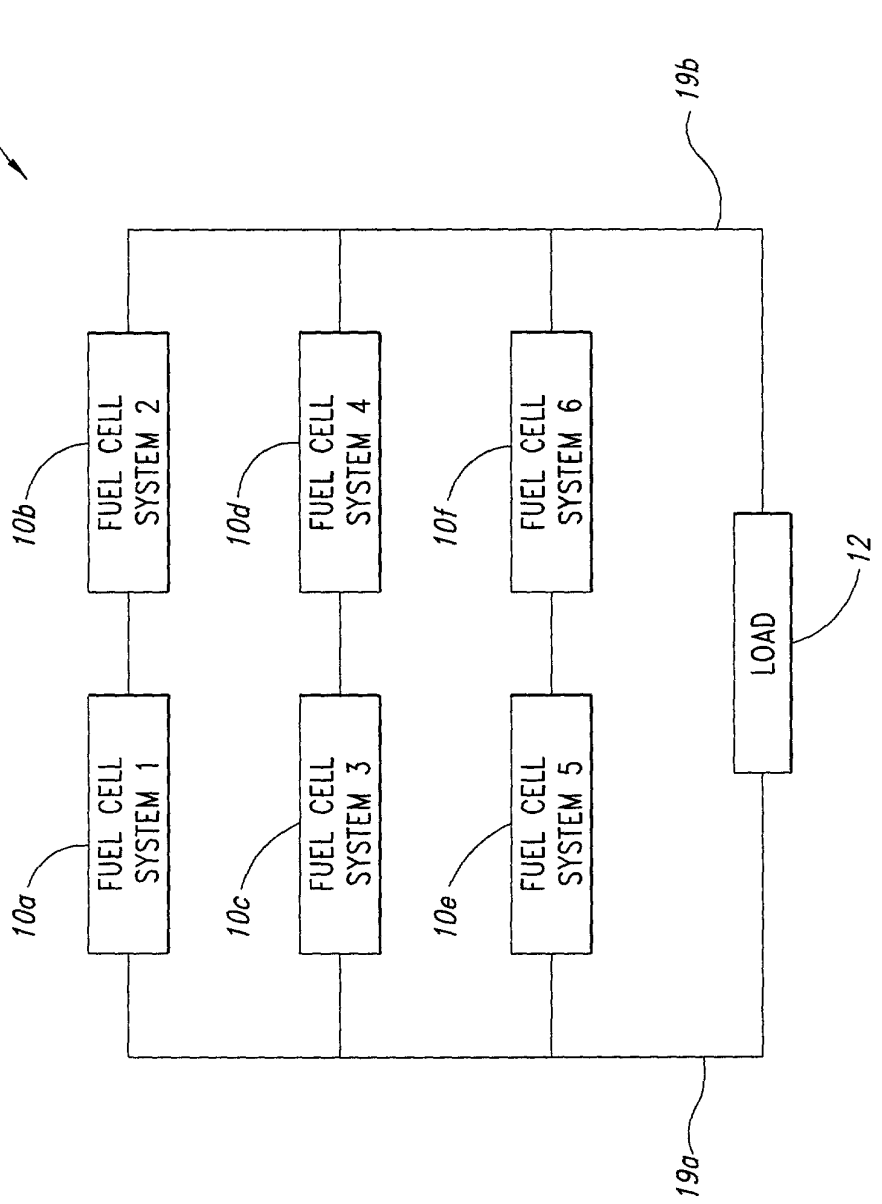

10g
19b
FUEL CELL SYSTEM 2
FUEL CELL SYSTEM 4
FUEL CELL SYSTEM 6
FUEL CELL SYSTEM 1
FUEL CELL SYSTEM 3
FUEL CELL SYSTEM 5
LOAD
10b
10d
10f
10a
10c
10e
12
19a

Fig. 6